

CLAIMS

What is claimed is:

1. A component assembly comprising:
a ceramic part;
a metal part comprised of a noble metal; and
a titanium-nickel interlayer material disposed between and in contact with
a surface of the ceramic part and a surface of the metal part wherein the ceramic
part and the metal part are bonded together by means of said titanium-nickel
interlayer material.
2. The component assembly of claim 1 wherein
said titanium-nickel interlayer material being a laminate foil.
3. The component assembly of claim 1 wherein
said component assembly being biocompatible to be suitable for use in
living tissue.
4. The component assembly of claim 1 wherein
said titanium-nickel interlayer being comprised of 50% nickel and 50%
titanium.
5. The component assembly of claim 1 wherein
said titanium-nickel interlayer being comprised of 67% titanium and 33%
nickel.
6. The component assembly of claim 1 wherein
said ceramic part being selected from the group consisting of alumina,
titania, zirconia, stabilized-zirconia, partially-stabilized zirconia, tetragonal

zirconia polycrystal, magnesia-stabilized zirconia, ceria-stabilized zirconia, calcia-stabilized zirconia, and yttria-stabilized zirconia.

7. The component assembly of claim 1 wherein
said noble metal being selected from the group consisting of platinum,
iridium, palladium, ruthenium, rhodium, and their respective alloys.

8. The component assembly of claim 1 wherein
said interlayer material being capable of forming a liquidus and creating a
bond between said metal part and said ceramic part subsequent to the assembly
being heated above a pre-selected temperature.

9. The component assembly of claim 8 wherein
the pre-selected temperature being greater than the liquidus point of the
interlayer material and less than the melting point of the metal part.

10. The component assembly of claim 1 wherein
said interlayer material having a thickness no greater than approximately
0.003 inches.

11. The component assembly of claim 1 wherein
said interlayer material being a thin coating of titanium-nickel disposed on
at least one of the surface to be bonded together.

12. The component assembly of claim 1 wherein
said interlayer material being a thin coating of titanium-nickel disposed on
at least one of the surfaces to be bonded together by means of electroless
plating or electroplating.

13. The component assembly of claim 1 wherein

said interlayer material being a thin coating of titanium-nickel that is disposed on at least one of the surfaces to be bonded together by means of depositing metallic beads or metallic powder on the surfaces.

14. The component assembly of claim 1 wherein

said interlayer material being a thin coating of titanium-nickel that is disposed on at least one of the surfaces to be bonded together by means of a thermal process selected from the group consisting of sputtering, evaporating, and ion beam enhanced deposition.

15. The component assembly of claim 1 wherein

said component assembly being hermetic.

16. A method of hermetically sealing a ceramic and metal component assembly, comprising the steps of:

- selecting a ceramic part;
- selecting a noble metal part;
- selecting an interlayer material being compatible with said ceramic part, said interlayer material being capable of forming alloys, intermetallics or solid solutions with said metal part, said interlayer material having a liquidus temperature and said noble metal part having a melting point;
- interposing said interlayer material between said ceramic part and said metal part;
- applying a force to said ceramic part and said metal part to place said interposed interlayer material in compression;
- placing said assembly in a non-reactive atmosphere;
- heating said assembly to a bonding temperature between said liquidus temperature of said interlayer material and said melting point of said noble metal part;
- holding said assembly at said bonding temperature for a predetermined time to form a bond between said ceramic part and said noble metal part; and
- cooling the assembly.

17. The method of claim 16 wherein
said step of selecting the interlayer material is selecting a laminate material.

18. The method of claim 16 wherein
said step of applying the force creates compression between 20 and 2000 psi.

19. The method of claim 16 wherein
said step of selecting the ceramic part is selecting from the group consisting of alumina, titania, zirconia, stabilized-zirconia, partially-stabilized

zirconia, tetragonal zirconia polycrystal, magnesia-stabilized zirconia, ceria-stabilized zirconia, yttria-stabilized zirconia, and calcia-stabilized zirconia.

20. The method of claim 16 wherein
said step of selecting the interlayer material is selecting a material
comprised of titanium-nickel.

21. The method of claim 16 wherein
said step of selecting the interlayer material is selecting approximately
0.003 inches or less thick foil.

22. The method of claim 16 further comprising the step of
applying said interlayer material chemically.

23. The method of claim 16 further comprising the step of
applying said interlayer material thermally.

24. The method of claim 16 further comprising the step of
applying said interlayer material in the form of metallic beads.

25. The method of claim 16 further comprising the step of
applying said interlayer material in the form of metallic powder.

26. The method of claim 16 further comprising the step of
placing said assembly in a vacuum atmosphere between approximately
 10^{-5} to 10^{-7} torr.

27. The method of claim 16 wherein
the holding said bonding temperature being between approximately 960°C
and 1080°C.

28. The method of claim 16 wherein the holding said predetermined time is between approximately 1 and 60 minutes.

29. The method of claim 16 additionally comprising the step of cleaning said component assembly after bonding to remove toxic materials that are harmful to living tissue.

30. The method of claim 29 additionally comprising the step of cleaning said component assembly after bonding by placing it in an acid bath.

31. A method of bonding a noble metal part to a ceramic part making a hermetically sealed component assembly, comprising the steps of:

selecting said ceramic part from the group comprised of tetragonal zirconia polycrystal ceramic;

selecting said metal part from the group consisting of platinum, iridium, palladium, ruthenium, rhodium, and their respective alloys;

interposing a laminate titanium-nickel foil between said ceramic part and said metal part;

applying a force to said ceramic part and said metal part to place said titanium-nickel foil in compression;

placing said component assembly in a non-reactive atmosphere;

heating said component assembly to between approximately 960°C and 1080°C for between approximately 1 and 60 minutes; and

cooling said component assembly.

32. The method of claim 31 wherein

said step of interposing a foil is interposing a foil comprised of approximately equal amounts of nickel and titanium.

33. The method of claim 31 wherein

said step of interposing a foil is interposing a foil comprised of approximately twice as much titanium as nickel.

34. A method of bonding a ceramic part to a metal part, having a melting point, to form a component assembly for placement in living tissue in which an interlayer material, having a liquidus temperature, is placed between the ceramic part and the metal part, applying a compressive force of 20 to 2000 psi to said ceramic part and said metal part placing said interlayer material in compression, said interlayer material capable of forming alloys, intermetallics or solid solutions with said metal part, and in which said component assembly is placed at a bonding temperature, for a predetermined time, that is less than the melting point of said metal part, but greater than the liquidus temperature of said interlayer material, and selecting said ceramic part from the group consisting of alumina, titania, zirconia, stabilized-zirconia, partially-stabilized zirconia, tetragonal zirconia, magnesia-stabilized zirconia, ceria-stabilized zirconia, yttria-stabilized zirconia, and calcia-stabilized zirconia, wherein the improvement comprises:

- selecting said metal part from a noble metal;
- selecting said ceramic part to be a tetragonal zirconia polycrystal;
- selecting said interlayer material to be titanium-nickel; and
- selecting said bonding temperature between approximately 960°C and 1080°C.

35. The method of claim 34 wherein
said noble metal being selected from the group consisting of platinum, iridium, palladium, ruthenium, rhodium, and their respective alloys.

36. The method of claim 34 wherein
said selecting the interlayer material is selecting a laminate material.

37. The method of claim 34 wherein
said selecting the interlayer material is selecting said interlayer material comprised of about equal proportions of nickel and titanium.

38. The method of claim 34 wherein

said step of selecting the interlayer material is selecting said interlayer material comprised of about twice as much titanium as nickel.